SPECIAL STUDY

MENOMINEE RIVER MENOMINEE COUNTY, MICHIGAN

SEPTEMBER 1992 U.S. ARMY ENGINEER DISTRICT DETROIT, MICHIGAN

SPECIAL STUDY MENOMINEE RIVER MENOMINEE COUNTY, MICHIGAN

TABLE OF CONTENTS

	PAGE
PREFACE	1
AUTHORITY	1
STUDY AREA	1
PRINCIPLE FLOOD PROBLEMS Factors Affecting Flooding and Its Impact Historical Flooding Future Floods Hazards of Large Floods Flood Protection Measures	3 3 4 4 4
ENGINEERING METHODS	5 5 5
BIBLIOGRAPHY	6
LIST OF FIGURES	
FIGURE 1 - VICINITY AND DRAINAGE AREA MAP	2
LIST OF TABLES	-
TABLE 1 - MAIN TRIBUTARIES TO MENOMINEE RIVER	3 4 5
LIST OF EXHIBITS	
Exhibit 1 - Marinette East, WisMich., Quadrangle Attachm Exhibit 2 - Marinette West, WisMich., Quadrangle Attachm Exhibit 3 - Chappee Rapids, MichWis., Quadrangle Attachm Exhibit 4 - McAllister, WisMich., Quadrangle Attachm Exhibit 5 - Swanson, MichWis., Quadrangle Attachm Exhibit 6 - Bear Point, MichWis., Quadrangle Attachm Exhibit 7 - Wausaukee South, WisMich., Quadrangle Attachm Exhibit 8 - Wausaukee North, Wis., Quadrangle Attachm Exhibit 9 - Resort Lake, MichWis., Quadrangle Attachm Exhibit 10 - Miscauno Island, WisMich., Quadrangle Attachm Exhibit 11 - Faithorn, MichWis., Quadrangle	ment ment ment ment ment ment ment

SPECIAL STUDY MENOMINEE RIVER MENOMINEE COUNTY, MICHIGAN

PREFACE

This report contains information, including maps with elevations, regarding the 100-year flood plain along the Menominee River from its mouth at Lake Michigan to the Menominee-Dickinson County line. With this information, minimum elevations for flood protection can be established. As part of this study, physical and hydrologic characteristics of the basin have been evaluated in determining the magnitude of the 100-year flood. It also provides a basis for land use planning and management for both structural and non-structural alternatives.

AUTHORITY

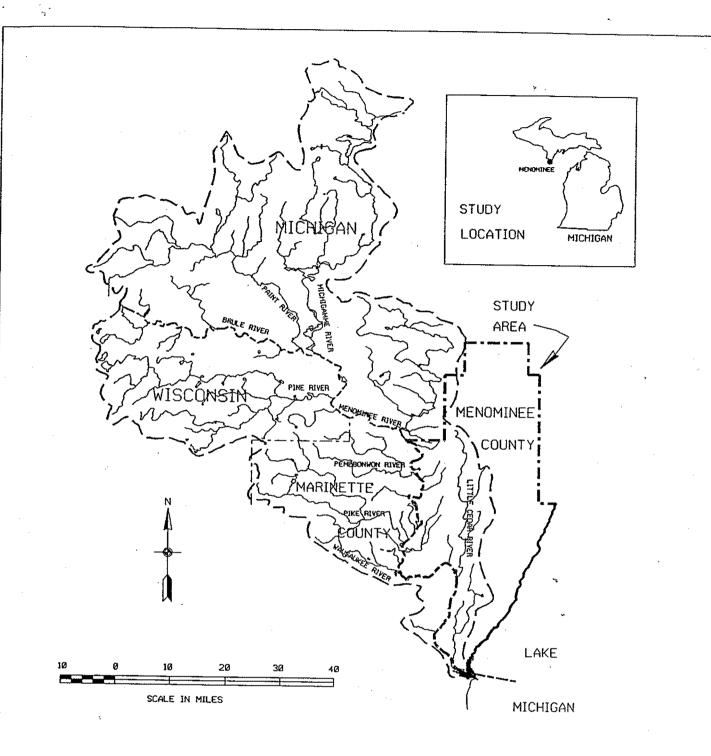
This report was prepared at the request of the Michigan Department of Natural Resources (MDNR), by letter dated May 8, 1991, as a special study of the Flood Plain Management Services Program, under the continuing authority provided in Section 206 of the Federal 1960 Flood Control Act (PL 86-645), as amended. Copies will be made available to interested agencies and individuals through this agency. The Detroit District, Corps of Engineers, will assist with the interpretation and use of the data presented.

STUDY AREA

Menominee County is the southernmost county in the upper peninsula of Michigan, located approximately 60 miles north of the city of Green Bay, Wisconsin. The Menominee River forms the western and southern border of the county, discharging into Green Bay (Lake Michigan) at the city of Menominee, at the southernmost point of the county. On the Wisconsin side, the river forms the eastern border of Marinette County, discharging into Green Bay at the city of Marinette, Wisconsin. A map of the Menominee River Basin is presented in Figure 1.

The river's drainage area varies from about 4,070 square miles at the mouth to about 2,920 square miles at the upstream county border. The length of the Menominee River within the county is 80 miles, with an average slope of about 3.0 feet per mile. At normal flows, the river has a width of approximately 150 to 500 feet within the study area. Tributaries to the Menominee River within the study area are shown in Table 1.

There are five hydropower dams and ten bridges over the Menominee River in the study area, plus the ruins of a sixth dam. About 50 percent of the fall in this section of the river occurs at the five dams. The bridges are designed to carry the 100-year flood with minimal head loss. A site visit was made on May 12 and 13, 1992, to familiarize study personnel with the bridges and dams, as well as other significant features, such as the Pemene Falls and Quiver Falls. Where available, sets of bridge plans and rating curves for the dams were obtained from the appropriate agencies.



MENOMINEE COUNTY, MI, SECTION 206 STUDY
VICINITY AND DRAINAGE AREA MAP
U.S. ARMY ENGINEER DISTRICT, DETROIT

FIGURE 1

TABLE 1 MAIN TRIBUTARIES TO MENOMINEE RIVER (Mile 0.0 to Mile 80.0)					
Stream Name	Location (Miles above Mouth)	Drainage Area) (Square Miles)			
Little River	5.5	61			
Little Cedar River	24.5	195			
Wausaukee River	43.0	57			
Shakey River	48.0	43			
Pike River	50.0	288			
Pemebonwon River	68.5	15			

PRINCIPLE FLOOD PROBLEMS

Factors Affecting Flooding and Its Impact

On some streams, natural obstructions such as ice formations, trees, brush and other bank growth impede flows, creating backwater and increasing flood heights and velocities. Bridges with inadequate openings can magnify the problem, causing more extensive flooding that would not otherwise occur. Trees, ice and debris may be carried downstream to collect at bridges and other obstructions to flow. As flood flows increase, ice and debris masses can break loose, releasing a wall of water surging downstream until another obstruction is encountered. These may collect against a bridge until the load exceeds its structural capacity, causing severe damage or destruction. Erosive velocities at bridge piers and approaches can also undercut foundations, causing their collapse.

In Menominee County, the Menominee River is wide enough that bank growth is not a major concern. Also, the ten bridges appear to be adequately sized so that, for unobstructed flow, they are sufficient to pass the 100-year flood without a significant backwater effect. However, there are some documented problems with ice. The United States Geological Survey (USGS) streamflow gage near Pembine, Wisconsin, has recorded sixteen occasions between 1950 and 1990, eight within the last eight years, in which the peak annual stage was caused by an ice jam.

Since it is impossible to predict the extent or location of the accumulation of ice and other types of debris, for our purposes it is assumed that no accumulations clog any of the bridge openings.

Historical Flooding

Based on the USGS streamflow records at Pembine and Koss, the main flood season on the Menominee River in Menominee County is in April and May. Out of 69 years of record at the Koss gage, the peak annual flow occurred 52 times in these two months. Out of 41 years of record at the Pembine gage, the peak annual flow occurred 29 times in these two months. Other likely times for flooding would include March, June, July and September. Floods in the vicinity of Menominee County which have caused significant damage occurred in 1916, 1951, 1953, 1960, 1965 and 1970.

The four USGS gages referred to in this study are listed in Table 2, along with other pertinent information. The flood of record at each location occurred in spring 1960. This flood ranges from a 40-year event near Pembine, Wisconsin, to a 75-year event near Florence, Wisconsin.

TABLE 2 USGS GAGES ON THE MENOMINEE RIVER						
Station Location	Gage #	Period of Record	Drainage Area (Sq. Mi.)	Peak Flow (cfs)	Date of Peak Flow	
Florence, WI	04063000	1915-90	1,780	19,500	4/26/60	
Pembine, WI	04066003	1950÷90	3,140	26,900	5/08/60	
Koss, MI	04067000	1908,14-81	3,720	33,000	5/10/60	
McAllister, WI	04067500	1945-90	3,930	32,500	5/09/60	

Future Floods

Future floods could be of equal or larger magnitude than those of the past. Larger floods have been experienced in regions of like topography, watershed cover and physical characteristics, under similar rainfall and runoff conditions.

Discussion of future floods in this report is limited to those that have been designated as the 100-year flood. This flood is defined as one which has an average frequency or probability of occurrence of once in 100 years, or a flood that has a one percent chance of happening in any one year at a designated location.

Hazards of Large Floods

The amount and extent of damage caused by a flood depends upon a number of factors. These include topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and development in the flood plain. Deep, debris laden floodwaters three or more feet deep and moving at a velocity of three or more feet per second could easily sweep an adult off his feet. Utilities can be ruptured by erosive action, thus contaminating domestic water supplies. Sanitary sewers can flood, causing basement backups. Extended periods of flooding can create severe hardships. Post-flood structural and sanitary problems, such as swelling, warping and settling of buildings and the widespread deposition of polluted debris and silt, confront all affected residents. Additionally, medical service, fire prevention and law enforcement are jeopardized by the disruptive effect.

Flood Protection Measures

No specific flood control projects are located within the study area. In many cases, however, the hydroelectric powerplants in the Menominee River Basin act to retard the flow of runoff to the downstream reaches of the river.

ENGINEERING METHODS

Hydrologic Analyses

The hydrologic analysis of the Menominee River in Menominee County is based on streamflows measured by the USGS. The river is gaged at the four locations shown in Table 2, with at least 41 years of record at each location. The USGS Water-Resources Investigations Report 91-4128, Flood-Frequency Characteristics of Wisconsin Streams, determined flood discharges at these locations. These determinations were based on criteria described in the U.S. Water Resources Council Bulletin 17B, Guidelines for Determining Flood Flow Frequency. For the present study, reference was also made to hydrologic data contained in the existing Flood Insurance Studies (FIS) at the City of Menominee, Michigan; Menominee Township, Michigan; and Marinette County, Wisconsin. Several bridge plans also had 100-year flood values associated with them. The USGS and FIS data was considered to be sufficient to adequately represent the study area, the USGS data given preference where differences occurred. Table 3 summarizes the discharges and drainage areas used in this study.

TABLE 3 SUMMARY OF DISCHARGES AND DRAINAGE AREA					
Location	Drainage Area (sq. mi.)	100-Year Discharge (cfs)			
Ogden Street Bridge	4,410	41,000			
Gage near McAllister	3,930	36,800			
Gage near Koss	3,720	34,900			
Gage near Pembine	3,140	31,700			
Gage near Florence	1,780	22,000			

Hydraulic Analyses

The hydraulic analyses are based on data obtained from the Flood Insurance Studies prepared for the City of Menominee, Michigan; Menominee Township, Michigan; and Marinette County, Wisconsin; rating curves at the USGS gages; an approximate field survey of bridge openings, water surfaces and channel sections made as a part of this study; headwater and tailwater rating curves for the hydropower dams; and bridge plans.

The Menominee River 100-year water surface was determined by the various Flood Insurance Studies for the lower seven miles of the river. The Marinette County study delineated the remaining section of river, using approximate methods. No elevations were published for this section of river. Most of the bridges in the study area have had a 100-year water surface elevation determined during their design phase. The 100-year water surface was also determined from rating curves at the Grand Rapids Dam, White Rapids Dam, Chalk Hill Dam and the USGS gages near Pembine and McAllister. Downstream and upstream of these locations, the water surface was assumed to change at the slope of the river, based on the current USGS topographic quadrangles. It was assumed that there would be no significant backwater at the bridges.

In some instances, two sources of information were available within a short distance. If the two sources differed by a significant amount, the more recent determination was used for this study. For example, the USGS gage near Pembine

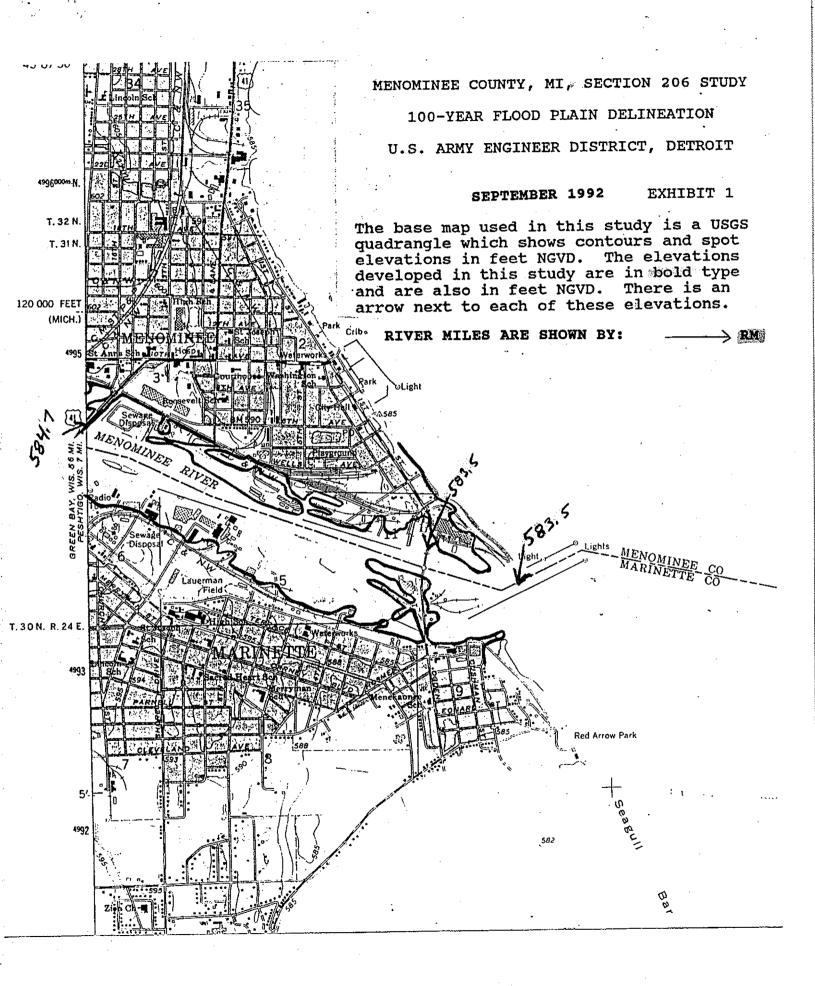
is 40 feet downstream of the Nathan Road bridge. The bridge plans (1970) listed an extreme high water elevation of 757.5 feet NGVD for a flow of 33,800 cfs, while the 1992 rating curve at the gage gives an elevation of 758.5 feet for the same flow. The higher elevation was used in this study. The 100-year flow at this site, based on a gage analysis, is 33,600 cfs, which only varies slightly from the 1970 value.

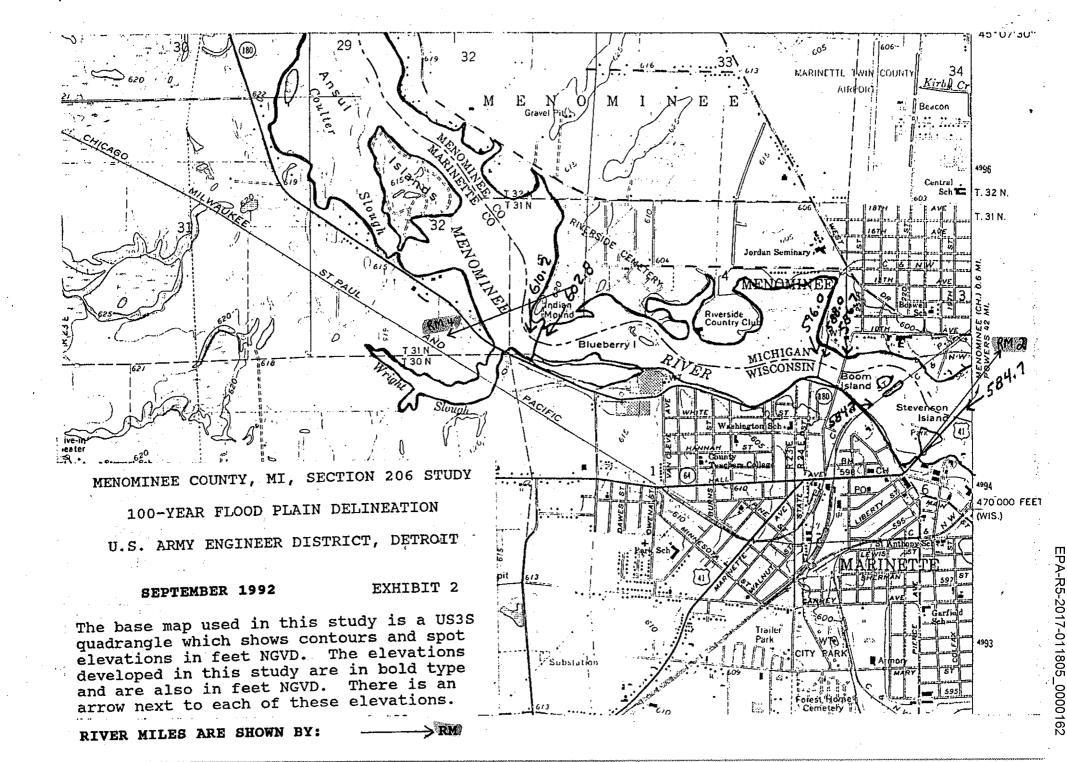
The 100-year flood plain boundary has been delineated on USGS Quadrangle maps at a scale of 1:24000 and a contour interval of 10 feet. The delineation is based on the water surface elevations discussed in this section of the report. Between the areas of analysis, the boundary was interpolated, using the Flood Insurance Rate Maps for the 1991 Flood Insurance Study for Marinette County, Wisconsin for reference purposes. Small areas within the flood plain boundary may lie above the flood elevation, but cannot be shown due to limitations of map scale and/or lack of detailed topographic data. All elevations are referenced to NGVD.

BIBLIOGRAPHY

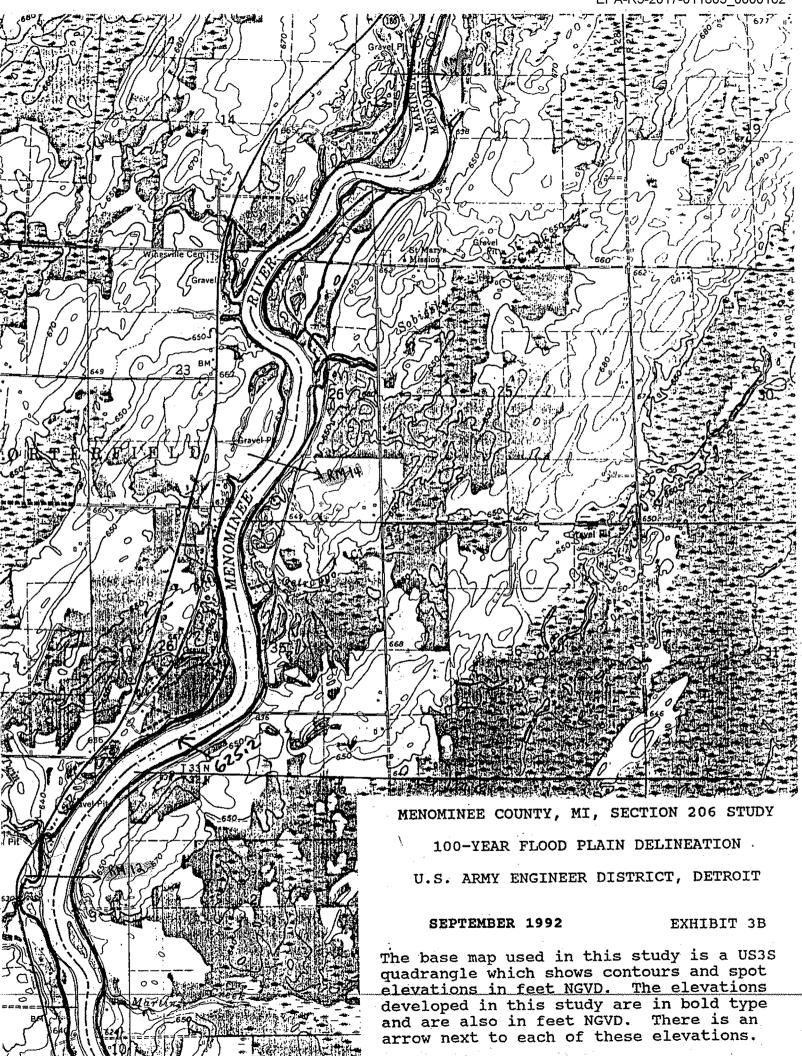
- U.S. Army Corps of Engineers, Milwaukee District, Menominee River, Michigan and Wisconsin, December 1930.
- U.S. Army Corps of Engineers, Chicago District, <u>Flood Plain Information</u>, <u>Menominee River Green Bay</u>, January 1975.
- U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Menominee, Michigan, February 1978.
- Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Menominee, Michigan, September 1979.
- Federal Emergency Management Agency, Flood Insurance Study, Marinette County, Wisconsin, March 18, 1991.
- Wisconsin Department of Natural Resources, <u>Drainage Area Data for Wisconsin Streams</u>, 1983.
- U.S. Geological Survey, <u>Water Resources Data for Michigan, Surface Water Records</u>, Lansing, Michigan, 1934-1990.
- U.S. Geological Survey, Water-Supply Paper 1677, <u>Magnitude and Frequency of Floods in the United States</u>, Part 4: St. Lawrence River Basin, Washington, D.C., 1965.
- Water Resources Council, Hydrology Committee, <u>Guidelines for Determining Flood</u> <u>Flow Frequency</u>, Bulletin #17B, Washington, D.C., 1981.
- U.S. Geological Survey, <u>Marinette East Quadrangle</u>, <u>Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1963.
- U.S. Geological Survey, <u>Marinette West Quadrangle, Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1963.
- U.S. Geological Survey, <u>Chappee Rapids Quadrangle</u>, <u>Michigan-Wisconsin</u>, Scale 1:24000, Contour Interval 10 Feet, 1963.
- U.S. Geological Survey, <u>McAllister Quadrangle</u>, <u>Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.

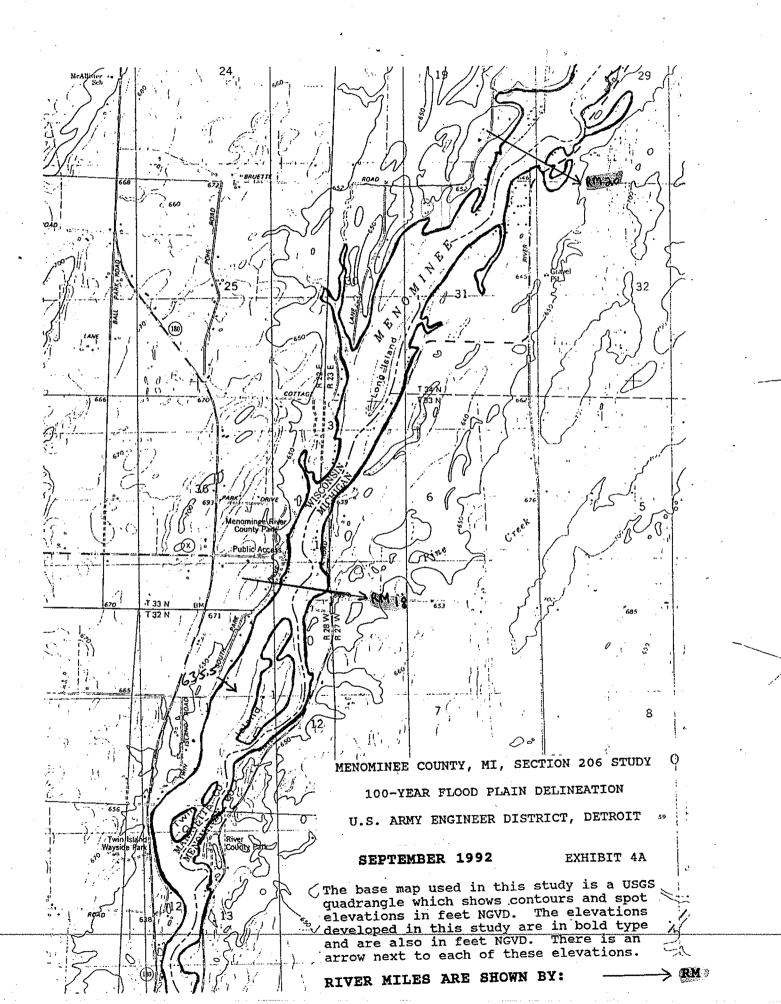
- U.S. Geological Survey, <u>Swanson Quadrangle</u>, <u>Michigan-Wisconsin</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Bear Point Quadrangle</u>, <u>Michigan-Wisconsin</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Wausaukee South Quadrangle</u>, <u>Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Wuasaukee North Quadrangle</u>, <u>Wisconsin</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Resort Lake Quadrangle</u>, <u>Michigan-Wisconsin</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Miscauno Island Quadrangle</u>, <u>Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Geological Survey, <u>Faithorn Quadrangle</u>, <u>Wisconsin-Michigan</u>, Scale 1:24000, Contour Interval 10 Feet, 1982.
- U.S. Army Corps of Engineers, Detroit District, Site Visit, May 12 and 13, 1992.

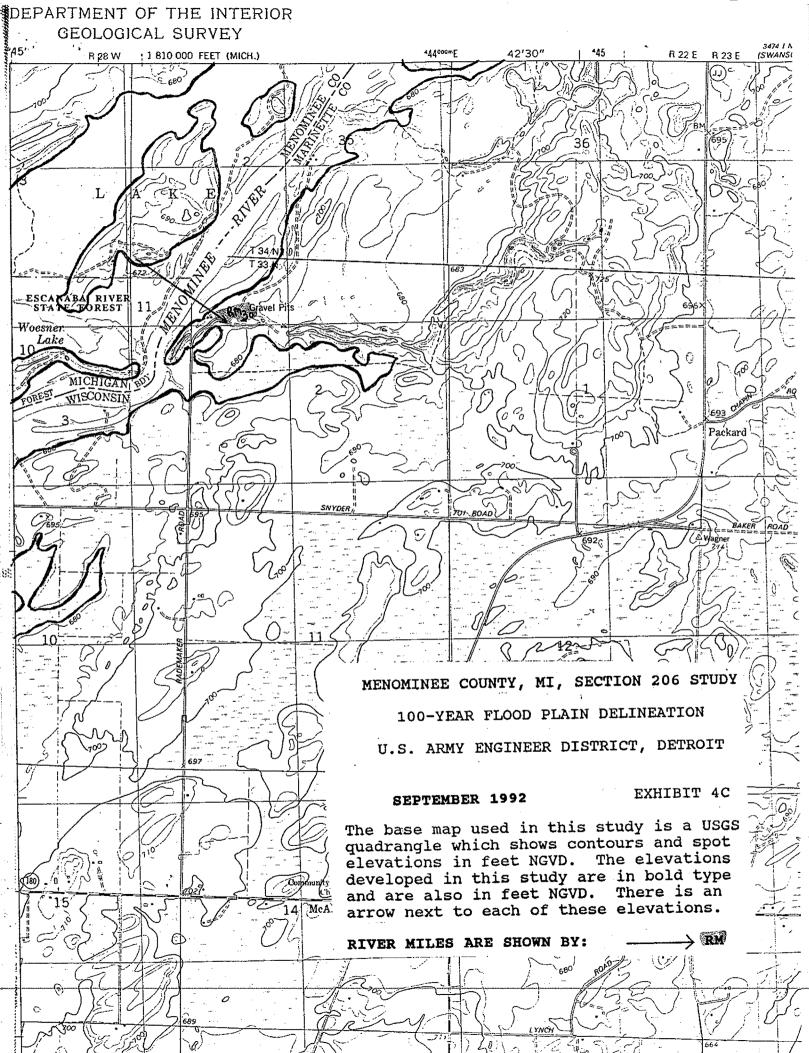


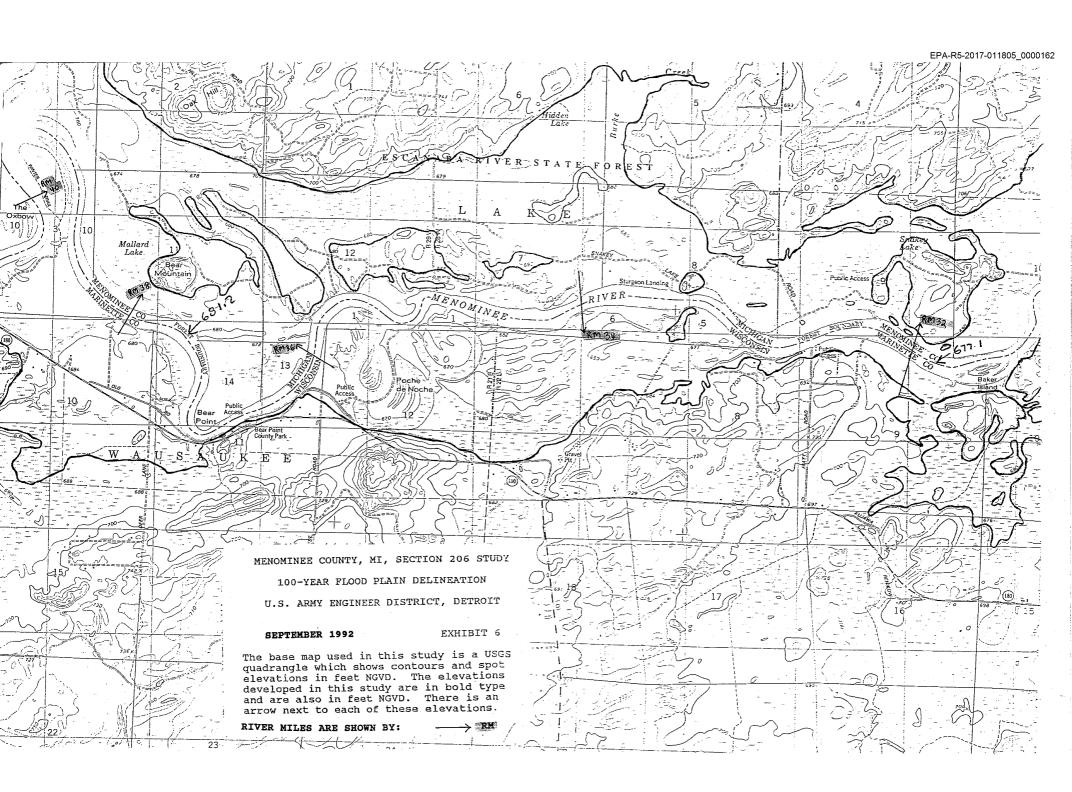


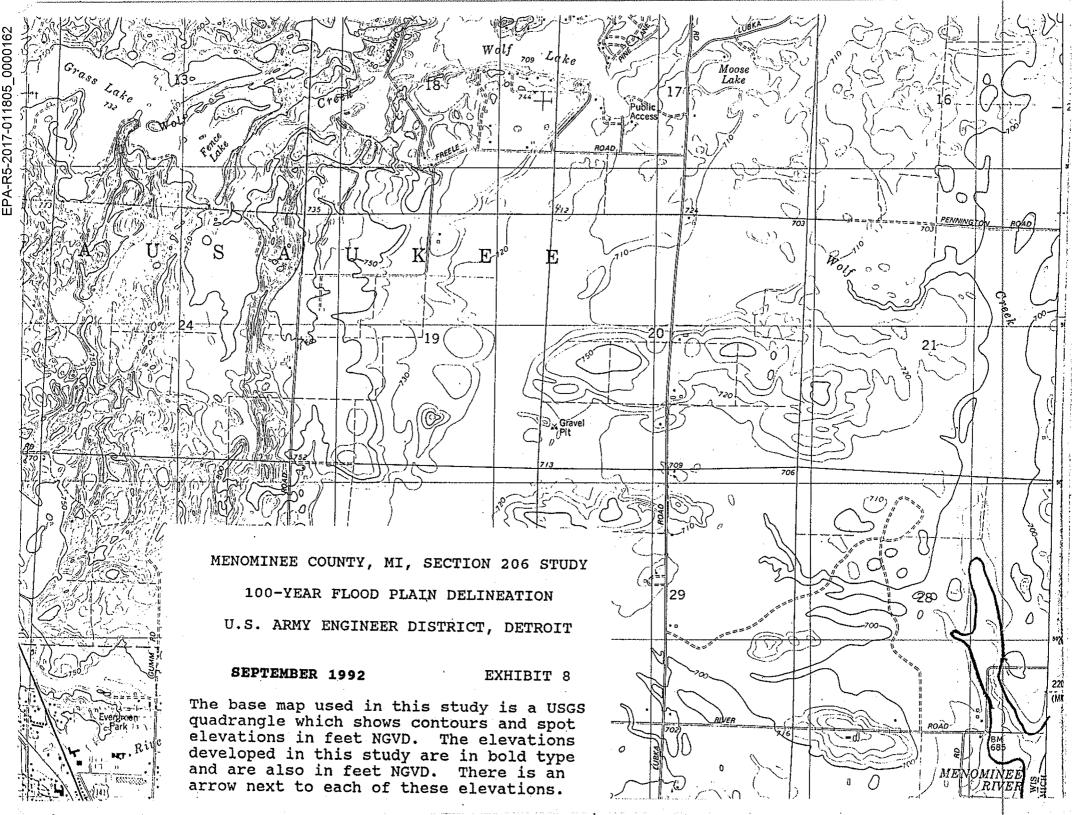


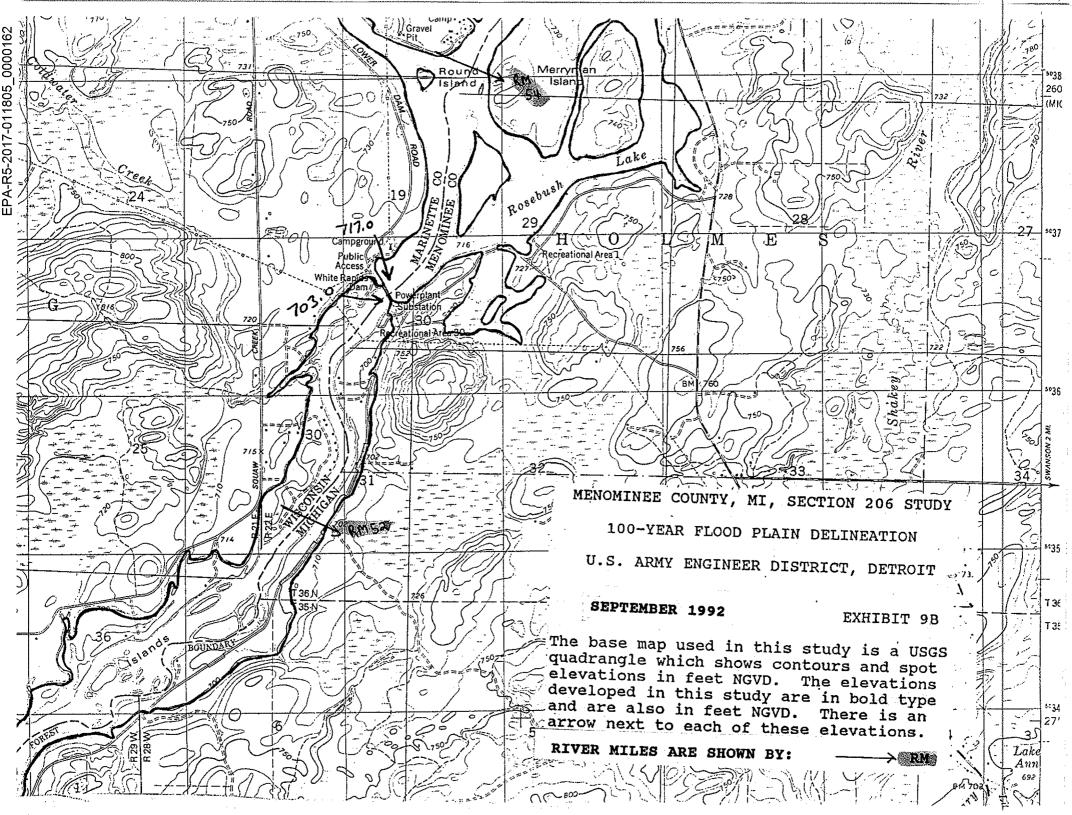


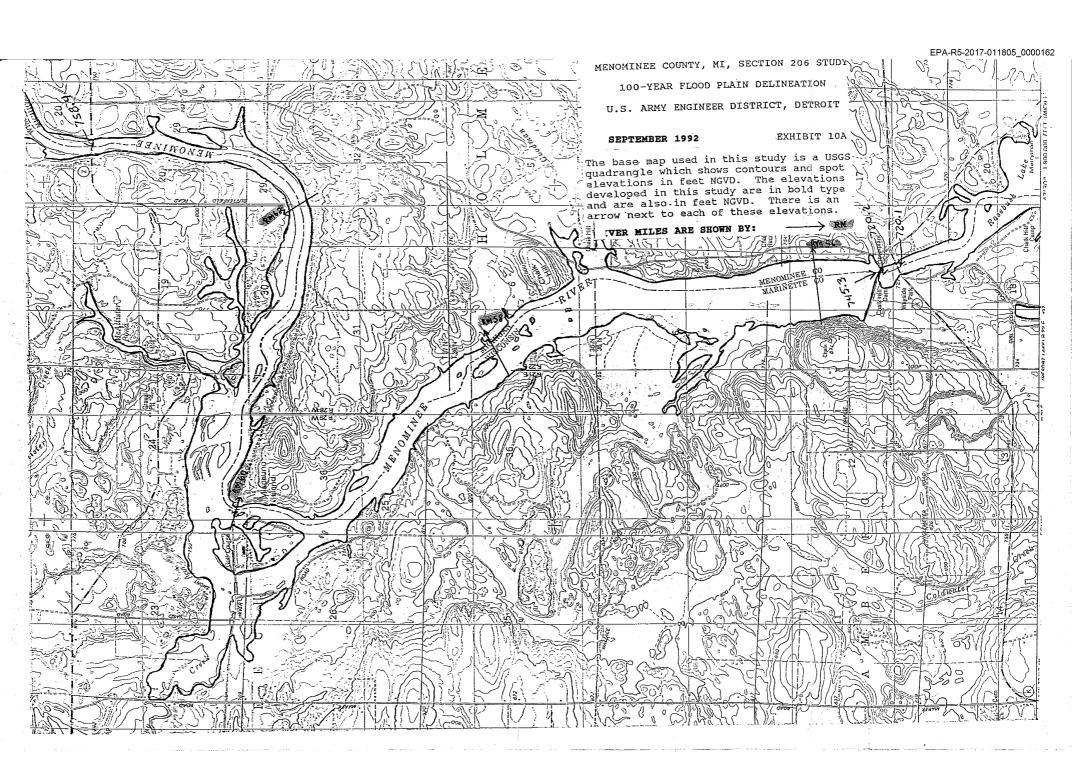


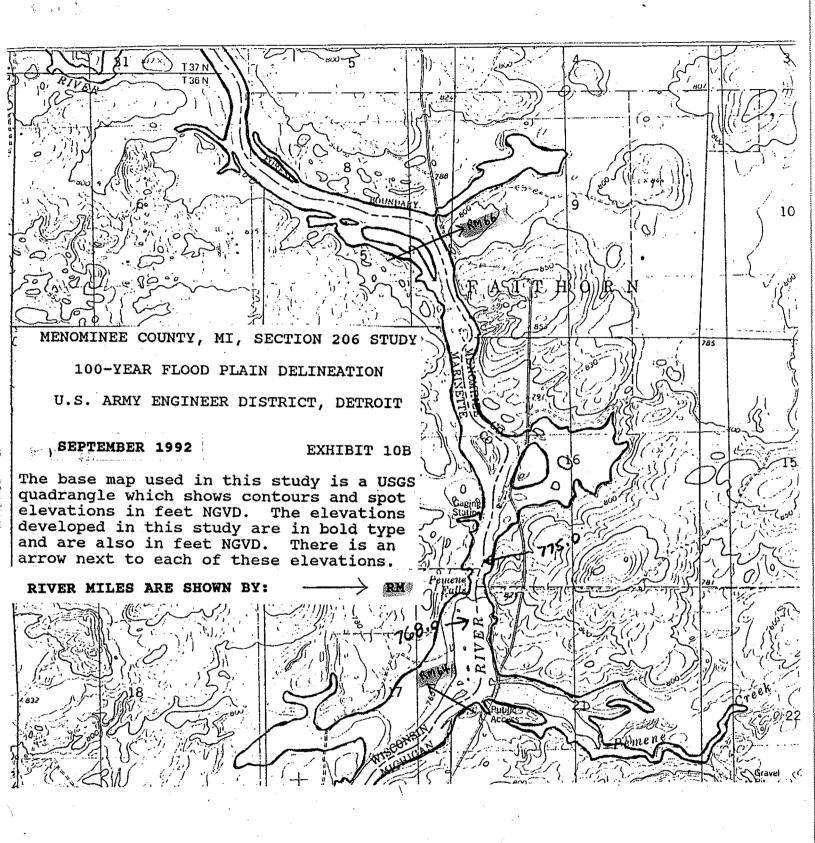


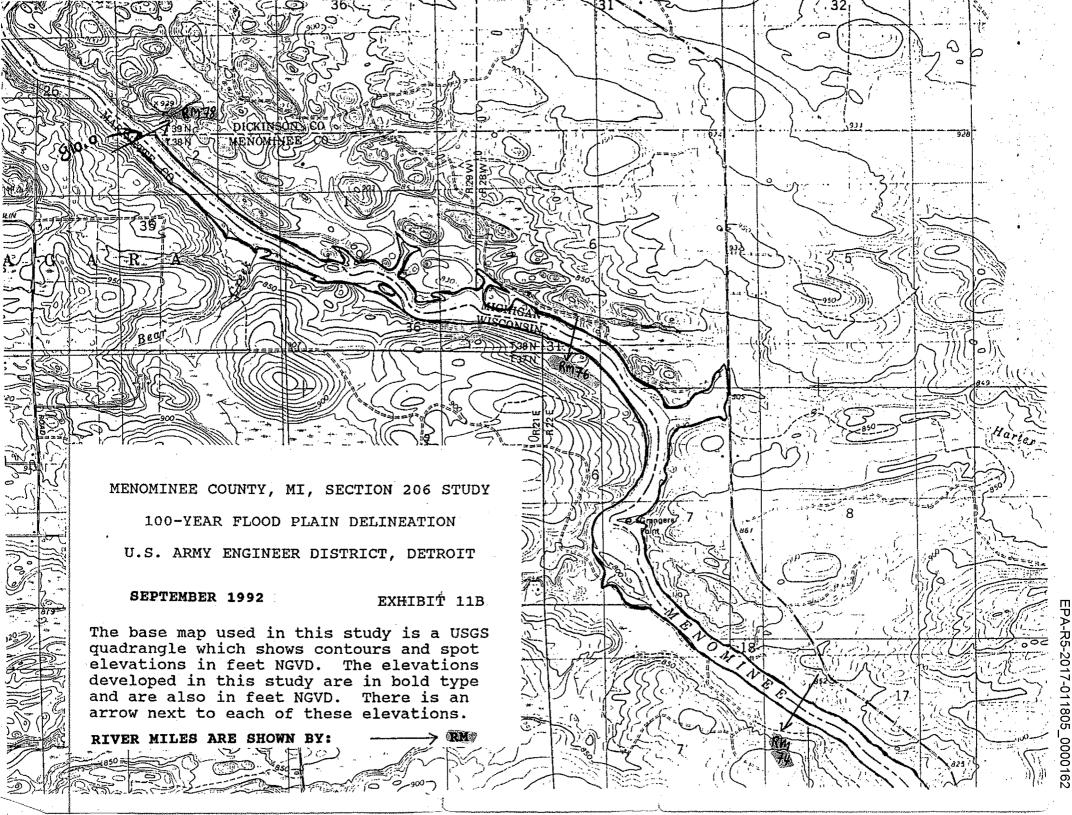












This Bench Mark Survey was completed by the Marinette County Surveyors Office in April-May, 1996. It is referenced to U.S. Corps of Engineers Temporary Bench Marks (TBM) surveyed by the Corps in January 1994 thru March 1994. That survey was authorized by the September, 1992 Special Study of the Menominee River 100 year flood plain by the U. S. Army Engineer District at Detroit, Michigan. Elevations in that study were referenced to NGVD 1929.

The 51 monuments set by the Marinette County Surveyors Office in 1996 are Berntsen 3/4" aluminum monuments driven to refusal by a Pionjar gasolene powered driver-breaker. Refusal was defined as driving the rod until movement slowed to less than 1 foot per minute.

Elevations determined on these monuments were transferred by optical level from nearby (generally 100 to 300 feet) Corps of Engineers temporary bench marks. Two instrument setups and observations were made approximately equidistant between the Corps TBM and the new monument.

Latitude and Longitude were determined by a hand held Magellan 2000 GPS receiver with estimated accuracy of 1 to 2 seconds of arc.

The 3-1/4" aluminum caps are stamped with the year and monument name. The monument name is a one or two digit number and the letter A, B, C, or D. The number corresponds with the adjacent Menominee River mile measured upstream from the mouth of the Menominee river. The letter denotes which quarter mile division of the river mile is nearest to the monument. The letter "A" corresponds with a position adjacent to the river mile; letter "B" corresponds with a position 1/4 mile upstream from the river mile; the letter "C" corresponds with a position 1/2 mile upstream from the river mile; the letter "D" corresponds with a position 3/4 mile upstream from the river mile. A USGS 7-1/2 minute quadrangle index map with the exact river mile location is available at the Marinette County Zoning or Survey Offices at the County Courthouse, 1926 Hall Ave.

Page 2 of 9

Marinette County Bench Mark 3D Elevation = 616.52

A 3/4" by 7-1/2' aluminum rod with a 3-1/4" cap which is 72' northeast of the centerline of STH 180; 600' east of Cox boat landing; 3' south of a 6' steel sign post; 2' south of the Northeast Corner of Section 2. In the NE-NE of Section 2-30-23, Latitude 45°06'24", Longitude 87°39'45". Referenced from Corps of Engineers TBM-4S2, a boat spike.

Marinette County Bench Mark 5A Elevation = 618.70'

A 3/4" by 23' aluminum rod with a 3-1/4" cap which is 40' east of the centerline of STH "180"; 0.35 mile south of Sequin Road; 1' south of a 6' steel sign post; across the road from the centerline of the first private drive north of the private drive to Marinette Iron & Metal. In the SE-NE of Section 31-31-23, Latitude 45°06'59", Longitude 87°40'49". Referenced from Corps of Engineers TBM-6S2, a boat spike.

Marinette County Bench Mark 5B Elevation = 623.08'

A 3/4" by 9' aluminum rod with a 3-1/4" cap which is 32' west of the centerline of STH "180"; 81.5' north of the centerline of Sequin Road; 1' east of a 6' steel sign post. In the SW-SE of Section 30-31-22, Latitude 45°07'17", Longitude 87°40'59". Referenced from Corps of Engineers TBM-7S2, a railroad spike.

Marinette County Bench Mark 6A Elevation = 622.20'

A 3/4" by 11' aluminum rod with a 3-1/4" cap which is 37' east of the centerline of STH "180; 0.90 mile north of Sequin Road; equidistant between r/w posts that are 8' apart; 1' south of a 6' steel sign post. In the NW-NE of Section 30-31-23, Latitude 45°08'00", Longitude 87°41'18". Referenced from Corps of Engineers TBM-1S3, a boat spike.

Marinette County Bench Mark 6D Elevation = 623.56'

A 3/4" by 10.5' aluminum rod with a 3-1/4" cap which is 1' south of a 6' steel sign post; 33' east of the centerline of STH "180"; 20' south of the extension of the centerline of Popple Road. In the SE-SW of Section 19-31-23, Latitude 45°08'19", Longitude 87°41'26". Referenced from Corps of Engineers TBM-2S3, a boat spike.

Marinette County Bench Mark 7A Elevation = 621.71'

A 3/4" by 14' aluminum rod with a 3-1/4" cap which is 36.5' east of the centerline of STH "180"; 56.5' west of the centerline of Nettleton Lane; 1' south of a 6' steel fence post; 77' northwesterly of the intersection of the center lines of Nettleton Lane and "180". In the SW-NW of Section 19-31-23, Latitude 45°08'34", Longitude 87°41'40". Referenced from Corps of Engineers TBM-3S3, a boat spike.

Marinette County Bench Mark 7D Elevation = 631,39

A 3/4" by 10' aluminum rod with a 3-1/4" cap which is 0.75 mile north of Nettleton Road; 36' east of the centerline of STH "180"; 115' north of the centerline of private drive "N5290"; 1' south of a 6' steel sign post'. In Government Lot 3 of Section 13-31-22, Latitude 45°09'03", Longitude 87°42'17". Referenced from Corps of Engineers TBM-4S3, a boat spike.

Page 3 of 9

Marinette County Bench Mark 8C Elevation = 640.52'

A 3/4" by 11' aluminum rod with a 3-1/4" cap which is 44.5' east of the centerline of STH "180"; 0.20 mile south of Woodview Road; 22' north of the centerline of private drive "N5498"; 1' south of a 6' steel sign post. In Government Lot 2 of Section 13-31-22, Latitude 45°09'32", Longitude 87°43'00". Referenced from Corps of Engineers TBM-5S3, a boat spike.

Marinette County Bench Mark 9D Elevation = 626.56

A 3/4" by 16' aluminum rod with a 3-1/4" cap which is: 1' South of a 6' steel sign post; 37' Northeast of the centerline of STH 180; 60' north of the centerline of private driveway N5854. In Government Lot 2 of Section 11-31-22, Latitude 45°10'11", Longitude 87°44'01". Referenced from Corps of Engineers TBM-7S3, a boat spike.

Marinette County Bench Mark 10B Elevation = 635.58'

A 3/4" by 11' aluminum rod with a 3-1/4" cap which is 45' west of the centerline of STH "180"; 69.5' north of CTH "G"; 1' south of a 6' steel sign post. In the SE-SE of Section 3-31-22, Latitude 45°10'45", Longitude 87°44'20". Referenced from Corps of Engineers TBM-8S3, a boat spike.

Marinette County Bench Mark 11B Elevation = 626.82

A 3/4" by 13' aluminum rod with a 3-1/4" cap which is 47' east of the centerline of STH "180; 255' north of the centerline of "old highway C"; 44' south of the centerline of private drive N6424; 1' west of a right-of-way post. In the SE-NE of Section 3-31-22, Latitude 45°11'21", Longitude 87°44'30". Referenced from Corps of Engineers TBM-9S3, a boat spike.

Marinette County Bench Mark 12A Elevation = 625.06'
A 3/4" by 11' aluminum rod with a 3-1/4" cap which is 1' south of a 6' steel sign post; 41' east of the centerline of STH "180"; 187' south of Twin Creek; 0.4 mile south of Twin Creek road. In

Government Lot 2 of Section 34-32-22, Latitude 45°12'04", Longitude 87°44'36". Referenced from Corps of Engineers TBM-10S3, a boat spike.

Marinette County Bench Mark 12D Elevation = 635.80'

A 3/4" by 23' aluminum rod with a 3-1/4" cap which is 71' east of the centerline of STH "180"; 39' west of the centerline of Shady Lane; 1' south of a 6' steel fence post; 111' northeast of the intersection of Shady Lane and STH "180". In the SW-SW of Section 26-32-23, Latitude 45°12'30", Longitude 87°44'06". Referenced from Corps of Engineers TBM-11S3, a boat spike.

Marinette County Bench Mark 13C Elevation = 638.33'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 0.75 mile north of STH "180"; 21.5' west of the centerline of Shady Lane; 143.5' south of private drive "N7261"; 96.5' north of the centerline of the northerly entrance to the "Evergreen"; 1' south of a 6' steel sign post. In Section 26-32-22, Latitude 45°13'03", Longitude 87°43'49". Referenced from Corps of Engineers TBM-12S3, a boat spike.

Page 4 of 9

Marinette County Bench Mark 14D Elevation

644.58 A 3/4" by 11' aluminum rod with a 3-1/4" cap which is at the northeast corner of STH "180" and Rastall Road; 53' east of the centerline of Rastall Road; 67' west of the centerline of STH "180"; 135' north of the intersection of the two center lines; 1' south of a 6' steel sign post'. In the SW-SE of Section 14-31-22, Latitude 45°14'07", Longitude 87°43'40". Referenced from Corps of Engineers TBM-13S3, a boat spike.

Marinette County Bench Mark 15B Elevation 655,47

A 3/4" by 7.5' aluminum rod with a 3-1/4" cap which is 45' west of the centerline of STH "180; 41.5' north of the centerline of private drive "N7891"; 115' north of the centerline of Twin Pine Lane. In the NW-SE of Section 14-32-22, Latitude 45°14'30", Longitude 87°43'23". Referenced from Corps of Engineers TBM-14S3, a boat spike.

Marinette County Bench Mark 16B Elevation 635,94'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 54' east of the centerline of STH "180"; 88' north of the centerline of Townline Road; 1' south of a 6' steel sign post. In the SW-SW of Section 12-32-22, Latitude 45°14'57", Longitude 87°42'50". Referenced from Corps of Engineers TBM-15S3, a boat spike.

Marinette County Bench Mark 16C Elevation 640.31

A 3/4" by 8' aluminum rod with a 3-1/4" cap which is 58' west of the centerline of STH "180; 58' north of the centerline of Konell Road; 1' south of a 6' steel sign post. In the SW-NW of Section 12-32-22, Latitude 45°15'21", Longitude 87°42'46". Referenced from Corps of Engineers TBM-1S4, a boat spike.

Marinette County Bench Mark 17A Elevation 657,78

A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 1' south of a 6' steel sign post; 50' east of the centerline of STH "180"; 53' north of the centerline of South Park Drive. In the SW-NW of Section 1-32-22, Latitude 45°16'13", Longitude 87°42'38". Referenced from Corps of Engineers TBM-3S4, a chiseled cross.

Marinette County Bench Mark 18A Elevation 665.45

A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 55' west of the centerline of STH "180"; 45' south of the centerline of CTH "X"; 1' south of a 6' steel fence post. In the NE-SW of Section 36-33-22, Latitude 45°16'49", Longitude 87°42'29". Referenced from Corps of Engineers TBM-4S4, a chiseled cross.

Marinette County Bench Mark 18D Elevation 642.25

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 23' east of the centerline of Cottage Lane; 320' south of the centerline of private drive N9308; 1' south of a 6' steel sign post. In Section 30-33-23, Latitude 45°17'26", Longitude 87°41'44". Referenced from Corps of Engineers TBM-6S4, a boat spike.

Page 5 of 9

Marinette County Bench Mark 19B Elevation = 646.66'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 35.5' east of the centerline of Cottage

Lane; 200' south of the centerline of private drive N9526; 0.5 mile south of Brunette Road; 1'

south of a 6' steel sign post'. In the SW-NW of Section 30-33-23, Latitude 45°17'53", Longitude

87°41'32". Referenced from Corps of Engineers TBM-7S4, a boat spike.

Marinette County Bench Mark 19D Elevation = 645.34'
A 3/4" by 20.5' aluminum rod with a 3-1/4" cap which is 50' west of the centerline of Cottage
Lane; 31' south of the centerline of Brunette Road; 1' south of a 6' steel fence post. In Section
19-33-23, Latitude 45°18'17", Longitude 87°41'28". Referenced from Corps of Engineers TBM8S4, a boat spike.

Marinette County Bench Mark 20C Elevation = 653.50'
A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 30' east of the centerline of Bruette Road;
57' south of the centerline of private drive W1793; 0.8 mile east and north of Cottage Lane; 1'
south of a 6' steel sign post. In the SW-SE of Section 19-33-23, Latitude 45°18'32", Longitude
87°40'46". Referenced from Corps of Engineers TBM-9S4, a boat spike.

Marinette County Bench Mark 22D Elevation = 653.75'
A 3/4" by 18.5' aluminum rod with a 3-1/4" cap which is 26' west of the centerline of Grand Rapids Road; 83' north of the centerline of Rasmussen Road; 1' south of a 6' steel sign post. In the SE-NE of Section 8-33-23, Latitude 45°20'25", Longitude 87°39'11". Referenced from Corps of Engineers TBM-13S4, a boat spike.

Marinette County Bench Mark 23A Elevation = 664.14'
A 3/4" by 11' aluminum rod with a 3-1/4" cap which is 0.3 mile north of Rasmussen road; 28' west of the centerline of Grand Rapids Road; 185' south of the centerline of private road N10825; 1' south of a 6' steel sign post. In the SE-NE of Section 8-33-23, Latitude 45°20'40", Longitude 87°39'12". Referenced from Corps of Engineers TBM-13S4, a boat spike.

Marinette County Bench Mark 26A Elevation = 685.04'

A 16" diameter concrete GPS monument with a 4" cap which is 0.65 mile south of the Koss Bridge; 28' east of the centerline of CTH "JJ"; 1' south of a 6' steel fence post. In the SW-SW of Section 30-34-23, Latitude 45°22'45", Longitude 87°42'36". Referenced from Corps of Engineers TBM-1S5, a 60 penny nail.

Marinette County Bench Mark 34A Elevation = 731.31'
A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 42' north of the centerline of STH "180";
200' east of Seefeldt Road; 1' south of a 6' steel sign post. In the SW-SW of Section 8-33-22,
Latitude 45°20'12", Longitude 87°47'51". Referenced from Corps of Engineers TBM-4S6, a boat spike.

Page 6 of 9

Marinette County Bench Mark 34D Elevation = 706.04

A 3/4" by 19.5' aluminum rod with a 3-1/4" cap which is 0.6 mile west of Lake Road(east end); 42' north of the centerline of STH "180"; 105' east of the centerline of private drive W4592; 1' south of a 6' steel sign post'. In the NE-SE of Section 12-33-21, Latitude 45°20'20", Longitude 87°49'09". Referenced from Corps of Engineers TBM-5S6, a boat spike.

Marinette County Bench Mark 36B Elevation = 677.96'

A 3/4" by 26' aluminum rod with a 3-1/4" cap which is 113' west of the intersection of Poch de Noch Road and STH "180"; 45' north of the centerline of "180"; 25' south of the centerline of Poch de Noch Road; 1' south of a 6' steel sign post. In the NE-SW of Section 12-33-21, Latitude 45°20'32", Longitude 87°49'52". Referenced from Corps of Engineers TBM-5S6A, a boat spike.

Marinette County Bench Mark 36C Elevation = 682.90'

A 3/4" by 26' aluminum rod with a 3-1/4" cap which is 55' north of the centerline of STH "180"; 54' west of the centerline of Forest Road; 1' south of a 6' steel sign post. In the NE-SE of Section 11-33-21, Latitude 45°20'33", Longitude 87°50'06". Referenced from Corps of Engineers TBM-6S6, a boat spike.

Marinette County Bench Mark 37A Elevation = 681.26'

A 3/4" by 17' aluminum rod with a 3-1/4" cap which is 51' north of the centerline of STH "180"; 200' east of old highway "C" (east end); 1' south of a 6' steel sign post. In the NE-SW of Section 11-33-21, Latitude 45°20'25", Longitude 87°51'04". Referenced from Corps of Engineers TBM-7S6, a boat spike.

Marinette County Bench Mark 37B Elevation = 682,87

A 3/4" by 18' aluminum rod with a 3-1/4" cap which is 54' north of the centerline of STH "180"; 56' east of the centerline of Deer Lane; 1' south of a 6' steel sign post. In the NE-NE of Section 10-33-21, Latitude 45°20'32", Longitude 87°51'22". Referenced from Corps of Engineers TBM-8S6, a chiseled cross on a culvert.

Marinette County Bench Mark 38A Elevation = 683.12'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 57' north of the centerline of STH "180"; 240' west of the centerline of old highway "C" (west end); 1' south of a 6' steel sign post. In the SW-NE of Section 10-33-21, Latitude 45°20'42", Longitude 87°51'52". Referenced from Corps of Engineers TBM-9S6, a chiseled cross on a culvert.

Marinette County Bench Mark 40D Elevation = 684.14'

A 3/4" by 12' aluminum rod with a 3-1/4" cap which is 1.1 miles east of Mud Lake Road (east end); 56' north of the centerline of STH "180"; 180' east of the centerline of private drive W5718; 1' south of a 6' steel sign post. In the NW-NW of Section 10-33-21, Latitude 45°20'58", Longitude 87°52'34". Referenced from Corps of Engineers TBM-10S6, a boat spike.

Page 7 of 9

Marinette County Bench Mark 41A Elevation = 689.68'

A 3/4" by 14' aluminum rod with a 3-1/4" cap which is 0.7 mile east of Mud Lake Road (east end); 42' south of the centerline of STH "180"; 232' west of the centerline of private drive W5843; 1' south of a 6' steel sign post'. In the NW-NE of Section 9-33-21, Latitude 45°21'01", Longitude 87°52'59". Referenced from Corps of Engineers TBM-1S7, a boat spike.

Marinette County Bench Mark 41C Elevation = 689.71'

A 3/4" by 23' aluminum rod with a 3-1/4" cap which is near the southeast corner of "180" and "X"; 200' east of the centerline of CTH "X"; 55' south of the centerline of STH "180"; 1' north of a 6' steel sign post. In the SW-SW of Section 4-33-21, Latitude 45°21'03", Longitude 87°53'47". Referenced from Corps of Engineers TBM-2S7, a boat spike.

Marinette County Bench Mark 41D Elevation = 698.05'

A 3/4" by 13' aluminum rod with a 3-1/4" cap which is near the southwest corner of "180" and Evergreen Road; 51' west of the centerline of Evergreen Road; 62.5' south of STH "180"; 1' north of a 6' steel sign post. In the SE-NW of Section 5-33-21, Latitude 45°21'41", Longitude 87°54'25". Referenced from Corps of Engineers TBM-3S7, a boat spike.

Marinette County Bench Mark 43B Elevation = 684.69'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is on the west side of Pike River Road at Bridge Road; 32' west of the centerline of Pike River Road; 67' north of the centerline of Bridge Road; 1' south of a 6' steel sign post. In the SW-SE of Section 28-34-21, Latitude 45°23'04", Longitude 87°52'29". Referenced from Corps of Engineers TBM-1S8, a boat spike.

Marinette County Bench Mark 44D Elevation = 699.74

A 3/4" by 9' aluminum rod with a 3-1/4" cap which is 31' west of the centerline of Pike River Road; 220' north of the centerline of Beach Road; 1' south of a 6' steel sign post. In the SE-SE of Section 21-34-21, Latitude 45°23'44", Longitude 87°52'29". Referenced from Corps of Engineers TBM-3S8, a boat spike.

Marinette County Bench Mark 46A Elevation = 698.16'

A 3/4" by 32' aluminum rod with a 3-1/4" cap which is 21' east of the centerline of Pike River Road; 277' north of the centerline of Pennington Road; 1' south of a 6' steel fence post. In the SW-SW of Section 15-34-21, Latitude 45°24'36", Longitude 87°52'31". Referenced from Corps of Engineers TBM-5S8, an electric box.

Marinette County Bench Mark 47C Elevation = 698.61'

A 3/4" by 12' aluminum rod with a 3-1/4" cap which is 0.25 mile north of Lubka Road; 28' west of the centerline of Pike River Road; 164' north of the centerline of private drive N12978; 1' south of a 6' steel sign post. In the SE-SE of Section 9-34-21, Latitude 45°25'37", Longitude 87°52'26". Referenced from Corps of Engineers TBM-7S8, a boat spike.

Page 8 of 9

Marinette County Bench Mark 48A Elevation = 718.74'
A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 26' east of the centerline of Pike River Road; 93' south of the centerline of Grogan Road; 1' south of a 6' steel sign post'. In the SW-SW of Section 3-34-21, Latitude 45°26'30", Longitude 87°52'26". Referenced from Corps of Engineers TBM-9S8, a boat spike.

Marinette County Bench Mark 49B Elevation = 710.92'
A 3/4" by 12' aluminum rod with a 3-1/4" cap which is 1.0 mile east of Pike River Road; 32'
north of the centerline of Squaw Creek Road; 151' east of the centerline of private drive W5318;
1' south of a 6' steel sign post. In the SW-SW of Section 35-35-21, Latitude 45°27'09",
Longitude 87°51'10". Referenced from Corps of Engineers TBM-13S8, a boat spike.

Marinette County Bench Mark 49D Elevation = 707.10'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 634 east of Squaw Creek; 24' south of the centerline of Squaw Creek Road; 1' south of a 6' steel sign post. In the SW-SE of Section 35-35-21, Latitude 45°27'14", Longitude 87°50'32". Referenced from Corps of Engineers TBM-14S8, a chiseled cross on a culvert.

Marinette County Bench Mark 50B Elevation = 718.35'
A 3/4" by 6' aluminum rod with a 3-1/4" cap which is 2.0 miles east and north of Pike River Road on Squaw Creek Road; 24' west of the centerline of Squaw Creek Road; 20' south of the centerline of private drive N13818; 1' south of a 6' steel sign post. In the NW-SE of Section 35-35-21, Latitude 45°27'33", Longitude 87°50'16". Referenced from Corps of Engineers TBM-15S8, a boat spike.

Marinette County Bench Mark 50D Elevation = 713.49'

A 3/4" by 15' aluminum rod with a 3-1/4" cap which is 2.8 miles east and north of the Pike River Road on Squaw Creek road; 25' north of the centerline of Squaw creek Road; 1346' west of the centerline of private drive N14050; 1' south of a 6' steel sign post. In the NW-NW of Section 36-35-21, Latitude 45°27'54", Longitude 87°49'41". Referenced from Corps of Engineers TBM-16S8, a chiseled cross on a culvert.

Marinette County Bench Mark 52A Elevation = 721.53'
A 3/4" by 15' aluminum rod with a 3-1/4" cap which 24' east of the centerline of Squaw Creek
Road; 45.5' north of the centerline of Summer Cloud drive (south); 1' south of a 6' steel fence
post. In the NW-SW of Section 30-35-21, Latitude 45°28'20", Longitude 87°48'46". Referenced
from Corps of Engineers TBM-17S8, a boat spike.

Marinette County Bench Mark 52B Elevation = 715.61'

A 3/4" by 8' aluminum rod with a 3-1/4" cap which is 0.1 mile north of Summer Cloud Road; 38' west of the centerline of Squaw Creek Road; 219' north of the centerline of private drive N14296; 1' east of a 6' steel sign post. In the NE-SE of Section 25-35-21, Latitude 45°28'24", Longitude 87°48'46". Referenced from Corps of Engineers TBM-18S8, a boat spike.

Page 9 of 9

Marinette County Bench Mark 52D

Elevation =

A 3/4" by 10' aluminum rod with a 3-1/4" cap which is 21' east of the centerline of Squaw Creek Road; 82.5' north of the centerline of Riverview Road; 1' south of a 6' steel sign post. In the SW-SW of Section 19-35-22, Latitude 45°28'52", Longitude 87°48'46". Referenced from Corps of Engineers TBM-19S8, a 4" brass capped iron pipe.

Marinette County Bench Mark 53D

Elevation = 741.78'

A 3/4" by 7' aluminum rod with a 3-1/4" cap which is 31' west of the centerline of Squaw Creek Road; 0.5 mile south of Chalk Hills Dam; 151' north of the centerline pf private drive N14897; 1' south of a 6' steel sign post. In the NE-NE of Section 24-35-21, Latitude 45°29'41", Longitude 87°48'48". Referenced from Corps of Engineers TBM-21S8, a 4" brass capped iron pipe..

Marinette County Bench Mark 54C

Elevation =

740.25

721.45

A 3/4" by 9' aluminum rod with a 3-1/4" cap which is 49' east of the centerline of Squaw Creek Road; 53' south of the centerline of CTH "K"; 1' south of a 6' steel sign post. In the SW-NW of Section 18-35-22, Latitude 45°30'17", Longitude 87°48'49". Referenced from Corps of Engineers TBM-22S8, a boat spike.

This is to certify:

That I have surveyed the elevations herein represented;

That the field notes for this survey are on file in the Marinette County Surveyors Office;

That I have made this survey at the request of the Marinette County Zoning Administrator;

And that this report is a true and correct representation thereof to the best of my knowledge and belief.

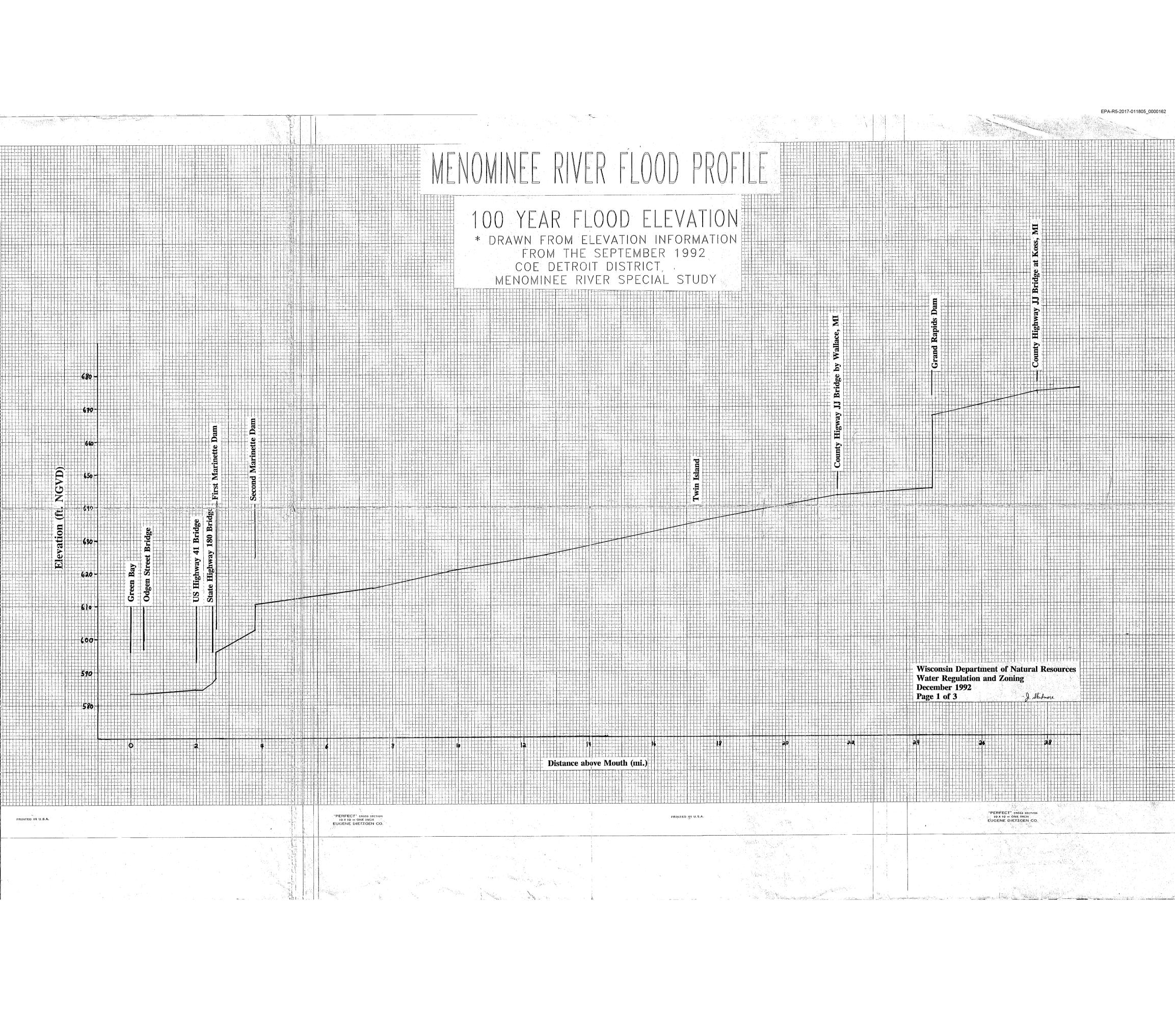
Jerome A. Pillath

Marinette County Surveyor S-1117

September 20, 1996

C:\OFFICE\WPWIN\WPDOCS\1996\MEN.BM







MENOMINEE RIVER FLOOD PROFILE

100 YEAR FLOOD ELEVATION

* DRAWN FROM ELEVATION INFORMATION FROM THE SEPTEMBER 1992 COE DETROIT DISTRICT MENOMINEE RIVER SPECIAL STUDY

The Oxbow

Distance above Mouth (mi.)

Water Regulation and Zoning
December 1992
Page 2 of 3

Wisconsin Department of Natural Resources

J. Shdmore

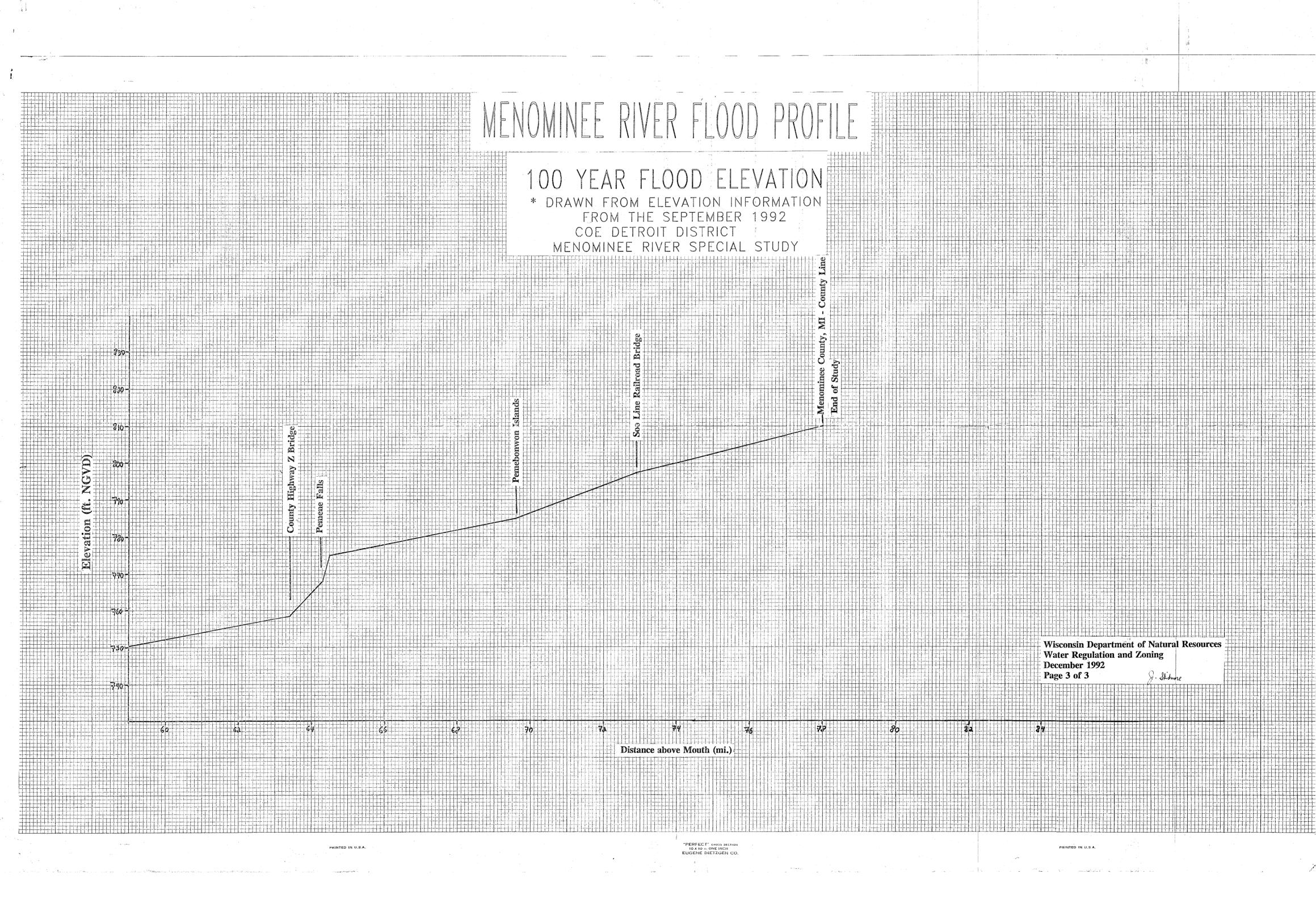
58

5y

"PERFECT" Bloss Section 10 x 10 a one inch Suits and Exercise 20

PHINTED IN U.S.A.

"PERFECT" CHOSS SECTION
10 X 10 — ONE INCH
EUGENE DIETZGEN CO.



EPA-R5-2017-011805_0000162